

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554**

In the Matter of	)	
	)	
Revision of Part 15 of the Commission's	)	ET Docket No. 13-49
Rules to Permit Unlicensed National	)	
Information Infrastructure (U-NII) Devices in	)	
the 5 GHz Band	)	

To: The Commission

**COMMENTS OF ARRL, THE NATIONAL ASSOCIATION
FOR AMATEUR RADIO**

ARRL, the national association for Amateur Radio, formally known as the American Radio Relay League, Incorporated (ARRL), by counsel and pursuant to Section 1.415 of the Commission's Rules (47 C.F.R. §1.415), hereby respectfully submits its comments in response to the *Notice of Proposed Rule Making*, FCC 13-22, 78 Fed. Reg. 21320, 28 FCC Rcd. 1769, released February 20, 2013 (the Notice). The Notice proposes, for the third time since 1997, to amend Part 15 of the Commission's Rules to expand the amount of spectrum available for operation of unlicensed National Information Infrastructure (U-NII) devices. Among other things, the Notice proposes to permit the operation of U-NII devices for the first time in the band 5.85-5.925 GHz. As that band is allocated on a secondary basis to the Amateur Service, ARRL has a substantial interest in the compatibility between U-NII devices in this band and incumbent Amateur station operation. For its comments on this portion of the Commission's proposal, ARRL states as follows:

I. Background.

1. The Amateur Service allocation at 5650-5925 MHz in the United States is a secondary allocation. Domestically, the entire band is allocated to the Government Radiolocation service (limited to military services) and to the Amateur Service on a secondary basis. By footnote, Amateur-Satellite Service, Earth-to-space operations are permitted in the band 5650-5670 MHz subject to not causing harmful interference to other services operating in accordance with the Radio Regulations. Space-to-Earth applications in the Amateur-Satellite Service are permitted in the segment 5830-5850 MHz, secondary as well to the Government Radiolocation service. Thus, there are important paired uplink and downlink segments in the Amateur-Satellite Service at 5.65-5.85 GHz, which are in the planning stages of deployment now. The upper portion of the overall Amateur allocation at 5 GHz, 5850-5925 MHz, is allocated to the Fixed-Satellite Service for uplinks and the mobile service, on a primary basis with the radiolocation service. In addition, the frequency 5800 MHz, plus and minus 75 MHz, is designated for industrial, scientific and medical (ISM) devices, thus impacting the 5850-5875 MHz segment.

2. The Amateur Radio allocation in the 5.650-5.925 GHz band has been subjected to a continuing series of overlays domestically in the past sixteen years. This began with the first U-NII provision in 1997.¹ The initial purpose of the generic U-NII Part 15 authorization was to encourage wireless Local Area Networks and to further enable mobile broadband access. The 1997 *Report and Order* in Docket No. 96-102 made available for this purpose under Part 15 a total of 300 MHz at 5150-5350 MHz and 5725-

¹ See the *Report and Order, Amendment of the Commission's Rules to Provide for Operation of Unlicensed U-NII Devices in the 5 GHz Frequency Range*, FCC 97-5, released January 9, 1997 in ET Docket No. 96-102.

5825 MHz. The lower (non-Amateur) segment was intended for, and was made available for higher-power devices. In making this band available for U-NII purposes, the Commission suggested:

With regard to sharing this band with Amateur operations, we believe that U-NII devices will cause little interference to amateur operations because of the relatively low power with which U-NII devices will operate. Further, we note that the amateur service has access to all spectrum within the 5.65-5.925 GHz range. We therefore believe that amateur operation will be able to avoid using frequencies within the 5.725-5.825 GHz band that are available to U-NII devices, in those rare cases where such avoidance may be necessary.

3. The Commission was not wrong in its conclusion; with some exceptions,² there has proven to be a good deal of compatibility in practice in the segment 5.725-5.825 GHz, though ARRL argued at the time that the Commission's premises were flawed: the Commission urged that fixed stations in allocated services might have to move in order to avoid interference from unallocated, unlicensed devices, which is contrary to normal spectrum management policy and contrary to the concept of unlicensed device operation under Part 15. ARRL also expressed concern at the time about the *aggregate* interference potential of these devices, which was neither considered nor quantitatively evaluated in the proceeding. In any case, of the 5650-5925 MHz available to the Amateur Service on a secondary basis (a total of 275 MHz), 100 MHz became less useful than it would be absent the initial U-NII authorization in Docket 96-102.

4. The second major event affecting the Amateur allocation at 5650-5925 MHz occurred in 1999, when the Commission allocated the 5850-5925 MHz segment to Part

² That segment includes the Amateur Radio national weak-signal calling frequency, 5760.100 MHz, which is used nationwide in the Amateur Service for narrowband propagation research and experimentation. There has been noted a very substantial increase in ambient noise in that frequency range in many areas which has had a substantially adverse effect on Amateur operation in the 200 kHz centered on that frequency. Extremely weak received signal levels are typical in this small segment.

90 Intelligent Transportation Services (ITS) direct vehicle-to-vehicle and vehicle-to-
roadside, or "Dedicated Short Range Communications" (DSRC).³ This allocation was,
again, justified in part on the basis that the Amateur Service has available to it "275
megahertz of spectrum in the 5.650- 5.925 GHz band." Given the mobile characteristics
of DSRC operations, it was anticipated that sharing opportunities for Amateurs in that
segment would be minimal. The Commission was clear in its instructions to Amateurs in
the 1999 *Report and Order* authorizing DSRC: Amateurs could continue to operate in the
band, but only to the extent that they do not interfere with DSRC operations.
Furthermore, there is a strong safety component of DSRC applications which concerned
Amateur licensees. However, due to cooperative efforts between ARRL and ITS America
in the years following the 1999 allocation, compatible sharing with DSRC has proven
reasonably successful, given the types of Amateur uses of this segment. However, the
restrictions were hardly conducive to expansion of Amateur operation. After the DSRC
allocation, Amateurs were left essentially with relatively uncompromised access only to
the 5650-5725 MHz segment (75 MHz) and the 5825-5850 MHz segment (25 MHz), a
total of 100 MHz. The lower of those two remaining segments was, just four years later,
the subject of Docket 03-122 in 2003.

5. Based on a petition for rulemaking (RM-10371) filed by the Wireless
Compatibility Alliance (WECA) sought to permit U-NII operation at 5470-5725 MHz,
the Commission in 2003 made available⁴ for U-NII devices an additional 255 MHz of

³ See, the *Report and Order*, FCC 99-305, 14 FCC Rcd. 18221 (released October 22, 1999 in ET Docket No. 98-95).

⁴ Revision of Parts 2 and 15 of the Commission's Rules to Permit Unlicensed National Information Infrastructure (U-NII) devices in the 5 GHz band, *Report and Order*, ET Docket No. 03-122, 18 FCC Rcd 24484 (2003).

spectrum in that band. The additional Part 15 authorization increased the total amount of spectrum in this frequency range for U-NII devices from 300 MHz to 555 MHz, despite any quantified need for additional U-NII spectrum or any showing of occupancy levels in the 300 MHz already available therefor. In comments filed in 2003 in Docket 03-122, ARRL noted potential compatibility between Amateur Radio and U-NII operation in that additional segment⁵ due to the Commission's proposal to require Dynamic Frequency Selection (DFS), Transmitter Power Control (TPC), and to limit the power of U-NII devices to 1 Watt e.i.r.p.⁶ ARRL pledged its cooperation with the RLAN industry on sharing related issues regarding this band. However, ARRL remained concerned about potential aggregate interference from U-NII devices in the 5.470-5.725 GHz band to Amateur Radio space stations in the 5.65-5.67 GHz band, and urged limits on U-NII operation in the 5.65-5.67 GHz band segment, in order to avoid interference to the

⁵ The necessity for the additional 255 MHz of spectrum for U-NII device deployment at 5 GHz proposed in 2003 was essentially settled from a regulatory perspective at the 2003 World Radiocommunication Conference (WRC-03), which allocated the band 5.47-5.725 GHz internationally to the mobile service for implementation of wireless access systems (WAS) including RLANs, subject to the provisions of Resolution 229. However, WRC-03 Resolution 229 noted the need to protect the existing primary services in the 5 GHz band. In relevant part, it resolved:

6 that in the band 5 470-5 725 MHz, stations in the mobile service shall be restricted to a maximum transmitter power of 250 mW with a maximum mean e.i.r.p. of 1 W and a maximum mean e.i.r.p. density of 50 mW/MHz in any 1 MHz band;

7 that in the bands 5 250-5 350 MHz and 5 470-5 725 MHz, systems in the mobile service shall either employ transmitter power control to provide, on average, a mitigation factor of at least 3 dB on the maximum average output power of the systems, or, if transmitter power control is not in use, then the maximum mean e.i.r.p. shall be reduced by 3 dB;

8 that, in the bands 5 250-5 350 MHz and 5 470-5 725 MHz, the mitigation measures found in Annex 1 to Recommendation ITU-R M.1652 shall be implemented by systems in the mobile service to ensure compatible operation with radiodetermination systems...

⁶ These requirements were not for the purpose of protecting Amateur Service stations. Rather, they were intended to protect the Earth Exploration Satellite Service (EESS) and Space Research Satellite (SRS) operations.

Amateur-Satellite service. ARRL also requested expansion of the DFS requirements to take into account more than just radar devices, and adoption of a requirement that all new U-NII devices operating in the 5.650-5.825 GHz band have TPC capability to further protect Amateur facilities.

6. The Commission adopted none of ARRL's proposals, concluding that:

As recognized by ARRL, our DFS and TPC requirements, while not specifically designed to protect amateur operations, will in fact protect amateur operations. In addition, because of the large amount of spectrum we are adding for U-NII devices along with the existing 300 MHz of U-NII spectrum, we expect the density of devices throughout the spectrum to be relatively low. We believe that this low density of devices coupled with our technical requirements will provide adequate protection to all incumbent systems in the band, including amateur satellite uplink systems.

Since 2003, there has been found to be a good deal of compatibility between Amateur Radio operation and U-NII devices in the 5 GHz range. That said, the level of U-NII deployment has not been as high as might be the case in the near future. As the Commission predicted, until now, U-NII operation has been a low density use. ARRL remains concerned about the aggregate interference potential of these devices going forward, given the Commission's current predictions of expanded U-NII operation. As is discussed *infra*, there is a good deal of current and future deployment of diverse applications at 5.85-5.925 GHz, and a U-NII overlay at the present time requires a good deal of compatibility analysis, none of which has been completed to date.

II. The Notice Proposal.

7. The Notice in this proceeding asks for comment on the Commission's proposal to authorize an additional 195 megahertz of spectrum in the 5.35-5.47 GHz and 5.85-5.925 GHz bands for U-NII use. This would increase the spectrum available to

unlicensed devices in the 5 GHz band, the Commission states, by approximately 35 percent. The Commission is obligated, pursuant to Section 6406 (a) of the “Middle Class Tax Relief and Job Creation Act of 2012” to begin a proceeding to modify part 15 of the Commission’s rules, to allow unlicensed U-NII devices to operate in the 5350-5470 MHz band.⁷ There is *no legislative obligation*, however, to make available the 5.85-5.925 GHz band for U-NII use.

8. There was, however, created by that same legislation an obligation on the part of the National Telecommunications Information Administration (NTIA) to study the impact on Federal systems should the FCC allow U-NII devices to operate in the 5350-5470 MHz *and* 5850-5925 MHz bands. NTIA, in consultation with the Department of Defense and other impacted agencies, assessed known and proposed spectrum-sharing technologies.⁸ The NTIA study, the results of which were released in January of this year, also evaluated the risk to Federal users if the Commission decided to authorize U-NII unlicensed devices in either of the two bands. Among the findings of NTIA in this study (at pages i and ii of the executive summary thereof) were the following:

Several federal agencies currently use the two potential 5 GHz expansion bands that are the subject of this study. Federal systems in these bands include a variety of radar systems installed on airborne, ground-based, shipborne, and space-based platforms. In addition to radar operations, federal users operate a number of airborne RF communications systems at sites across the United States in these bands to conduct, for example, testing and training of unmanned aircraft systems (UAS) data and command links for intelligence, surveillance, reconnaissance and combat search and rescue missions... In the 5850-5925 MHz band, additional allocated and authorized uses include non-federal fixed-satellite uplinks (Earth-to-space) and federal and non-federal mobile services. The non-federal mobile service allocation is limited to Dedicated Short Range Communications Service (DSRCS)

⁷ See Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. No. 112-96, § 6406, 126 Stat. 156, 231 (2012), 47 U.S.C. § 1453.

⁸ See, *Evaluation of the 5350-5470 MHz and 5850-5925 MHz Bands Pursuant to Section 6406(b) of the Middle Class Tax Relief and Job Creation Act of 2012*, U.S. Department of Commerce, January, 2013.

systems operating in the Intelligent Transportation System radio service...

...(T)his report identifies a number of risk elements due to the likelihood of harmful interference from large numbers of U-NII devices to protected federal systems in the 5350-5470 MHz and 5850-5925 MHz bands. The report discusses suggested mitigation strategies for each risk element. For example, the report identifies potential risks for federal airborne, ground-based, and shipborne radar systems related to changes in radar signal parameters or changes to U-NII device deployment and technical parameters, which current regulations may not be equipped to adequately address. Another risk element is that existing U-NII regulations were not developed to detect airborne signals. Suggested mitigation strategies include the development of representative technical parameters and sharing scenarios where the transmitters and receivers are not co-located to perform quantitative analysis to evaluate whether current regulations would protect airborne operations. The report also addresses risks and mitigation strategies to protect spaceborne receivers.

The report concludes that further analysis will be required to determine whether and how the identified risk factors can be mitigated through, for example, the promulgation of new safeguards in addition to the FCC's existing requirements. Accordingly, NTIA, in collaboration with the federal and industry stakeholders and the FCC, will conduct quantitative analysis of potential mitigation requirements in connection with regulatory proceedings. In the next phase of its assessments, NTIA will lead detailed quantitative studies described more fully in this report, which will include additional analysis and measurements to evaluate the feasibility of existing, modified, proposed and new spectrum-sharing technologies and approaches.

NTIA has not yet released any results of those quantitative analyses of interference mitigation requirements. It is noteworthy, however, that NTIA has raised precisely the same concern that ARRL has raised repeatedly in earlier proceedings concerning the 5 GHz band: that the *aggregate* interference potential of ubiquitous U-NII devices to incumbent radio services (or as NTIA put it, "the likelihood of harmful interference from large numbers of U-NII devices to protected federal systems in the... 5850-5925 MHz band...") is currently unknown. Because NTIA plans to investigate the extent to which U-NII devices can compatibly share the 5850-5925 MHz band with protected Federal

systems, it would be *premature* to permit U-NII devices to operate at 5850-5925 MHz.

The instant Notice, at paragraph 77, invites comments on the NTIA study itself, “including its underlying assumptions and risk assessments.” At this point, that would be a difficult task, since NTIA has not completed its evaluation of interference mitigation techniques and spectrum-sharing technologies and approaches. As such, its risk assessments are not complete and not ready for review by the public.

9. At paragraph 88 of the Notice, the Commission summarizes the incumbent users of the 5.85-5.925 GHz band as follows:

Frequency Band	Service Type	Federal Primary	Non-Federal Primary	Non-Federal Secondary
5.85-5.925 GHz	Radiolocation	X		
5.85-5.925 GHz	Fixed Satellite(Earth to Space)		X	
5.85-5.925 GHz	Mobile Service		X	
5.85-5.925 GHz	Amateur Service			X

A complete study of interference potential and mitigation techniques should take into consideration the potential interaction between U-NII devices (including the aggregate interference potential of those devices) and each of the above incumbent services, and applicable mitigation techniques with respect to each and all of these incumbent services, as well as the extent to which aggregate interference could be mitigated.

10. Prior to the January, 2013 release of the NTIA study, ITS America wrote to NTIA’s Assistant Secretary for Communications and Information by letter dated January 10, 2013 expressing concern about potential interference from U-NII devices to DSRC operations. The letter detailed the DSRC applications that are in the process of deployment nationwide and which have numerous safety-based applications including vehicle-to-vehicle and vehicle-to-roadside applications. DSRC stands to make driving

safer. ITS America expressed grave concern that NTIA's process had not at that time developed a complete record or provided an opportunity for participation by the transportation community. ITS America noted that Congress intentionally permitted a longer period for the 5.9 GHz component of the NTIA study than it did for the component of the study applicable to the 5350-5470 MHz band, but NTIA chose to combine the two required studies into one. The result of the truncated period for the 5850-5925 MHz portion of the study, as NTIA admits in the Executive Summary quoted extensively above, was that its evaluation of interference mitigation techniques and their effectiveness in protecting incumbent uses from interference is at this point incomplete.

11. The inevitable conclusion from a review of the NTIA study, the ITS America letter to NTIA, and from a review of the Commission's Notice in this proceeding is that a decision in the near term with respect to the addition of U-NII devices to the 5.85-5.925 GHz band would be premature. The present allocation status of this band is quite complicated due to the presence of important Federal systems, safety-based DSRC applications (including connection between vehicles and vehicles to roadsides to detect and avoid hazards in a vehicle's path); fixed-satellite applications and fixed and mobile Amateur radio facilities. An additional overlay of unlicensed, high-use density mobile applications requires careful planning. ARRL suggests that a full and complete investigation of the sharing concerns be conducted in an open, transparent manner and that the Commission should proceed at the present time to permit operation of U-NII devices only in the 5350-5470 MHz band.

III. Amateur Use of 5.85-5.925 GHz.

12. The Notice in this proceeding says very little about incumbent Amateur Radio Service operation in the 5.85-5.925 GHz band. At paragraph 94, the Commission states as follows:

Amateur service stations are permitted to transmit in the 5.85-5.925 GHz frequency segment on a secondary basis. Operation of these stations in this frequency segment must not cause harmful interference to, and must accept interference from, authorized stations in the fixed-satellite (earth to space) and mobile services (DSRC) and also stations authorized by other nations in the fixed service.⁹ The FCC does not have detailed information on use of this band by amateur service stations.

Recently, a new band plan has been developed to reflect present uses of the secondary Amateur Radio 5 GHz allocation at 5650-5925 MHz. With respect to Amateur uses above 5830 MHz, the Amateur Satellite Service downlink band is at 5830-5850 MHz and the segment 5830-5925 MHz is used for analog and digital wide-bandwidth (i.e. those using emissions of greater than or equal to 1.0 MHz occupied bandwidth) applications. These include high-speed data (e.g. 802.11 protocols), Amateur television and other high-bandwidth, high-speed multimedia Amateur Radio applications. Channelization of that segment is based on regional needs and usage.

13. While broadband types of Amateur Radio applications in this segment are flexible and can be coordinated with DSRC, fixed-satellite uplinks, and most Federal operations relatively easily, it is not at all a simple matter to avoid interference to Amateur Radio facilities from unlimited numbers of mobile U-NII devices. ARRL urges that the Commission take a slower, more deliberate approach to a U-NII spectrum

⁹ See 47 C.F.R. § 97.303(r)(2).

overlay in the 5.85-5.925 GHz segment, due to the nature of the varied technologies in this band and because of the large number of unknown factors that might affect interaction between U-NII facilities and incumbent, licensed, allocated radio services in this band.

14. Should the Commission nevertheless proceed to authorize U-NII devices to operate in the additional 5.85-5.925 GHz band, there are some established interference mitigation techniques which might be effective in implementing sharing between Amateur Radio and U-NII devices in this portion of the 5 GHz band. A reasonable place to start to develop sharing protocols with U-NII devices at the outset would be to require U-NII devices to utilize the following operating parameters, intended for U-NII devices by WRC-03 Resolution 229 as a means of protecting existing primary services lower in the 5 GHz band from U-NII device interference:

(a) power shall be restricted to a maximum transmitter power of 250 mW with a maximum mean e.i.r.p. of 1 W and a maximum mean e.i.r.p. density of 50 mW/MHz in any 1 MHz band; and

(b) U-NII devices shall either employ transmitter power control to provide, on average, a mitigation factor of at least 3 dB on the maximum average output power of the systems, or, if transmitter power control is not in use, then the maximum mean e.i.r.p. shall be reduced by 3 dB; and

(c) mitigation measures, including dynamic frequency selection (DFS) listen-before-transmit techniques found in Annex 1 to Recommendation ITU-R M.1652 shall be implemented by U-NII devices to ensure compatible operation with systems in other services.

15. The above mitigation measures were not specifically intended to protect the Amateur Service secondary allocation at 5 GHz or the Amateur-Satellite Service allocations in the 5 GHz band, and their value and sufficiency in addressing aggregate

interference from U-NII devices is unknown. However, the Amateur Services derive some benefit from them on a case-by-case basis. The e.i.r.p. limits set forth in that Recommendation are intended to, and would, provide a certain level of protection for incumbent services. The dynamic frequency selection (DFS) listen-before-transmit technique specified in Recommendation ITU-R M.1652, could help to protect Amateur operations, although this Recommendation was based on technical studies of potential interference from RLANs to radars, not to amateur station receivers, which have different characteristics. ARRL would also support the use of transmit power control (TPC) for U-NII devices in the 5 GHz band, to cause a 6 dB reduction in transmit power for U-NII devices when triggered. The same should be required for all new U-NII devices operating elsewhere in the 5.650-5.925 GHz segment. The combination of an e.i.r.p. limit not to exceed one watt, plus DFS and TPC, should help to minimize instances of interference between U-NII devices and Amateur stations in this band.

16. In summary, ARRL would suggest that the overall history of sharing in the 5 GHz range between Amateur Radio operations and U-NII devices and systems in the same bands has been reasonably positive. That said, there has not been an abundance of U-NII deployment in the Amateur secondary allocation between 5.65 and 5.925 GHz to date. The Amateur Service has a long history of successful sharing in several frequency bands above 900 MHz. Over time, however, the Amateur Service has consistently had its 5 GHz secondary allocation diminished in utility. This is especially true of the 5.85-5.925 MHz segment, due to necessary (albeit compatible) sharing with DSRC, fixed satellite uplinks, and Federal government facilities. ARRL would urge that the Commission avoid a “rush to judgment” with respect to the 5.85-5.925 GHz band. It is suggested that the

Commission proceed to permit U-NII devices in the 5350-5470 MHz band. However, any decision on a U-NII overlay in the 5.85-5.925 GHz band should await a full and complete NTIA evaluation of interference potential and interference mitigation techniques among the varied and important incumbent uses of that segment, and an opportunity for the public to evaluate the results of the NTIA study.

Now, therefore, the foregoing considered, ARRL, the National Association for Amateur Radio, respectfully requests that the Commission implement U-NII in the 5.85-5.925 GHz segment, in accordance with the recommendations contained herein, and not otherwise.

Respectfully submitted,

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